Name _____Period _____

Candy Stoichiometry

Your Tasks (Mark these off as you go)

- ☐ Define key vocabulary
- ☐ Determine the average mass of one "mole" of candy
- ☐ Convert between grams, pieces, and "moles" of candy
- ☐ Explore the stoichiometry of candy reactions
- ☐ Receive credit for this lab

❑ Define key vocabulary

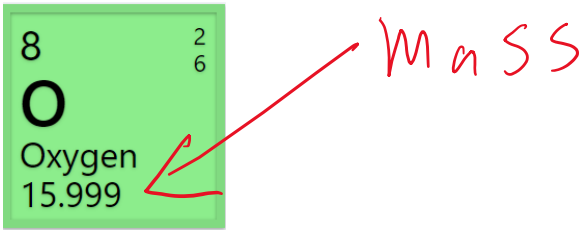
Avogadro's number

Molar mass

❑ Determine the average mass of one "mole" of candy

Recall that the mass of any element can be identified by using the periodic table.

Below is a screenshot of oxygen from the periodic table. Notice the number on the bottom represents the mass of the element. So, in atomic mass units, the mass of oxygen would be written as 16.0 amu.



Previously we learned that atomic mass units are not a very useful measurement – we do not have an atomic mass unit balance! Grams however are. Recall that if we have an Avogadro's amount (6.022×10^{23}) of atoms, the mass of the element can be expressed in grams.

For example,

6.022×10^{23} atoms of oxygen = 16.0 g

Also recall, that the quantity, 6.022×10^{23}, is referred to as a mole. That is,

1 mole = 6.022×10^{23} things

Putting this all together, we now have a relationship for moles, atoms, and mass,

1 mole = 6.022×10^{23} atom = mass of element (g)

Because a mole represents a fixed number of things, 1 mole of hydrogen weighs less than 1 mole helium,

1 mole H = 1.0 g
1 mole He = 4.0 g

The concept of a mole can also be applied to other things. Consider for example how the mass of 1 mole of mini marshmallows compares to the mass of 1 mole of peanut m & m's. While the number of mini marshmallows and m & m's are the same. The mass of 1 mole of m&m's greater because on average they weigh more,

1 mole mini marshmallows = 6.022×10^{23} mini marshmallows
1 mole m & m's = 6.022×10^{23} m & m's

mass of 1 mole m & m's > mass of 1 mole mini marshmallows

For each pair indicate what weighs more,	
1 mole cotton balls	1 mole marbles
1 mole hot tamales	1 mole mini marshmallows
1 mole jelly bellys	1 mole mini snicker bars

6.022×10^{23} is a HUGE number and representing amounts of candy in moles is inconvenient. So, instead, we will represent our amounts of candy in terms of a unit you are more familiar with, the dozen. But the concept is still the same,

mass of 1 dozen m & m's > mass of 1 dozen marshmallows

For the remainder of this lab 1 "mole" of candy will represent 12 pieces of candy, or 1 dozen.

Obtain 12 gumdrops
Mass each gumdrop and record the mass in the data table below
When you are done, calculate the average mass of 1 of one gum drops
Repeat the above for hot tamales, mini marshmallows, and candy corn
Multiply the average mass by 12 – this will represent the mass of 1 mole of your candy, or the molar mass.

Data table 1: Average mass of 1 dozen

	Mass gumdrops	**Mass hot tamales**	**Mass mini marshmallows**	**Mass candy corn**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
Average				
Molar mass				

❑ Convert between grams, pieces, and "moles" of candy

Mass the provided bags of candy. Using the average mass of 1 "mole" of each candy, complete the following. DO NOT open the bags!			
Gumdrops			
Bag	**Mass**	**"Moles"**	**Pieces**
1			
2			
3			
Hot tamales			
Bag	**Mass**	**"Moles"**	**Pieces**
1			
2			
3			
Mini marshmallows			
Bag	**Mass**	**"Moles"**	**Pieces**
1			
2			
3			
Candy corn			
Bag	**Mass**	**"Moles"**	**Pieces**
1			
2			
3			

Complete the following table for each unknown bag of candy			
Unknown 1			
Identity	**Mass**	**"Moles"**	**Pieces**
			24
Unknown 2			
Identity	**Mass**	**"Moles"**	**Pieces**
		0.5	
Unknown 3			
Identity	**Mass**	**"Moles"**	**Pieces**
			6

❑ Convert between grams, pieces, and "moles" of candy compounds

Elements on the periodic table can be represented with symbols and so too can our candy. To explore our candy reactions, we will use the following symbols to represent each type of candy.

Mini Marshmallows = M
Hot tamales = T
Gumdrops = G
Candy corn = C

Refer to the molar mass for each candy, then calculate the mass of 1 "mole" of each candy compound.	
Compound	**Mass of 1 "mole"**
M_2	
T_2	
M_2T	
G	
MC	
GC_2	

Refer to the mass of 1 "mole" of each candy compound above to complete the following table.		
M_2T		
Mass	**"Moles"**	**Candy compound units**
		6
	1.5	
GC_2		
Mass	**"Moles"**	**Candy compound units**
	0.25	
		4
MC		
Mass	**"Moles"**	**Candy compound units**
	2	
		2

❑ Explore the stoichiometry of candy reactions

Consider the following hypothetical candy reaction,

$2M_2 + T_2 \rightarrow 2M_2T$

Combine pieces of candy to make each reactant combination. Then rearrange the pieces to create as many M_2T compounds as you can. Record the amounts of products, and the amounts of leftovers in the data table below.

Reactants		**Products**	**Leftovers**	
M_2	T_2	M_2T	M_2	T_2
8	8			
5	8			
4	8			
6	3			

Calculate the "moles" and mass of M_2T you made for each combination.

Reactants		**Moles**	**Mass**
M_2	T_2	M_2T	M_2T
8	8		
5	8		
4	8		
6	3		

Calculate the "moles" and mass of leftovers

Reactants		**Leftovers**			
M_2	T_2	Moles M_2	Mass M_2	Moles T_2	Mass T_2
8	8				
5	8				
4	8				
6	3				

Consider the following hypothetical candy reaction,

$G + 2MC \rightarrow GC_2 + M_2$

Combine pieces of candy to make each reactant combination. Then rearrange the pieces to create as many M_2T compounds as you can. Record the amounts of products, and the amounts of leftovers in the data table below.

Reactants		**Products**		**Leftovers**	
G	MC	GC_2	M_2	G	MC
4	4				
6	3				
2	4				
3	3				

Calculate the "moles" and mass of GC_2 you made for each combination.

Reactants		**Moles**	**Mass**
G	MC	GC_2	GC_2
4	4		
6	3		
2	4		
3	3		

Calculate the "moles" and mass of leftovers

Reactants		**Leftovers**			
G	MC	Moles G	Mass G	Moles MC	Mass MC
4	4				
6	3				
2	4				
3	3				

❑ Receive Credit for this lab

Each group member must complete and submit their own lab to receive credit